

Betty, the 25th significant tropical cyclone of 1980, developed east of Truk Atoll from a weak disturbance which had been monitored for almost a week in the eastern Caroline Islands. Just prior to passing south of Guam, Betty attained typhoon strength and then continued to intensify as she tracked into the Philippine Sea. About 12 hours prior to landfall on Luzon, Betty reached her peak intensity of 125 kt (64 m/sec). During the 18 hours that Betty tracked over north central Luzon, she weakened considerably, but in the process caused extensive damage and loss of life. Downgraded to tropical storm strength, Betty moved northeastward through the Bashi Channel and eventually dissipated as a weak extratropical low southeast of Japan.

Betty had her origin in a weak disturbance south of Truk which showed increased potential for development on the 27th and 28th of October. The 280000Z gradient level winds from Truk and Ponape, as well as low-level winds from a weather reconnaissance flight west of the disturbance, indicated a closed circulation with 20 to 25 kt (10 to 13 m/sec) winds. At 280800Z, a Tropical Cyclone Formation Alert (TCFA) was issued and, during the alert period, the disturbance veered sharply to the east as it approached Truk on an erratic course from the south. After veering, hourly reports from Truk and satellite imagery indicated increased organization, and the first warning for TD 25 was issued at 290000Z with maximum surface winds of 30 kt (15 m/sec).

Despite the erratic movement shown during its formative stages and the apparent northeastward trajectory TD 25 had assumed by the first warning, the initial and subsequent warnings correctly identified a west-northwest track which indicated passage just south of Guam. However, due to limited mid-level (700 mb or 500 mb) steering data north of Betty, the first six warnings failed to adequately forecast her acceleration which resulted in a speed of movement of 21 kt (39 km/hr) as she passed Guam. As a result, although the 72 hour forecast position of the second warning predicted Betty's exact position as she passed south of Guam, the average vector error during this period was very high. The 72 hour forecast position mentioned above, had a total error of 585 nm (1083 km) due to the acceleration which caused Betty to reach the 72 hour point in just 34 hours! Such errors resulting from under forecasting speed of movement highlight the importance of adequate mid-level data in the steering current. When

available, especially from reconnaissance aircraft, such data usually increase the ability of forecasters to evaluate the potential for changes in the short-term, as well as long-term motion of tropical cyclones.

After passing south of Guam, Typhoon Betty turned west and continued to intensify, reaching 100 kt (61 m/sec) 48 hours later. During this period, the 500 mb analyses began to show a short wave trough moving east through mainland China. JTWC forecasts keyed on this feature and, based on computer-derived prognostic charts, recurvature was expected to begin near 125E by 030000Z. The probability of this forecast verifying increased when, at 020000Z, the short wave trough deepened as it moved off Asia. However, by 021200Z, Betty unexpectedly turned southwestward. By 030000Z, the trough had moved quickly eastward north of Betty and the opportunity for recurvature had passed. Shortly afterwards, attention focused on another short wave moving through China and recurvature was again forecast to occur, this time just east of Luzon. By 040000Z, however, available 500 mb data did not show any significant amplitude to this trough and the recurvature track was abandoned in favor of a northwestward track over Luzon into southern China.

Although Betty continued to intensify after passing Guam, the data normally used to evaluate a tropical cyclone's intensity showed considerable scatter. Figure 3-25-1 graphically depicts these data as well as the final best track intensities. In searching for an explanation of the scatter, the comments from mission ARWOs on 01 November and 04 November may offer some insight concerning the character of Betty during this period. On the 011594Z mission: "Although this storm (Betty) was strong, it had no eye-wall. The most fascinating feature was the rotating feeder band of convection that was spiralling inward at an enormous rate." On this single fix mission, a maximum 700 mb flight level wind of 95 kt (49 m/sec) was observed. However, daylight missions before and after this mission estimated surface winds in excess of 100 kt (51 m/sec) (Fig. 3-25-2). On the 032200Z, 040150Z and 040340Z fix missions, it was observed that "Typhoon Betty....was a textbook typhoon. Everything was aligned perfectly." On 040600Z, Betty reached her peak intensity of 125 kt (64 m/sec). The development of a textbook typhoon correlated closely with the reduction in scatter between maximum surface wind estimates shown in Figure 3-25-1.

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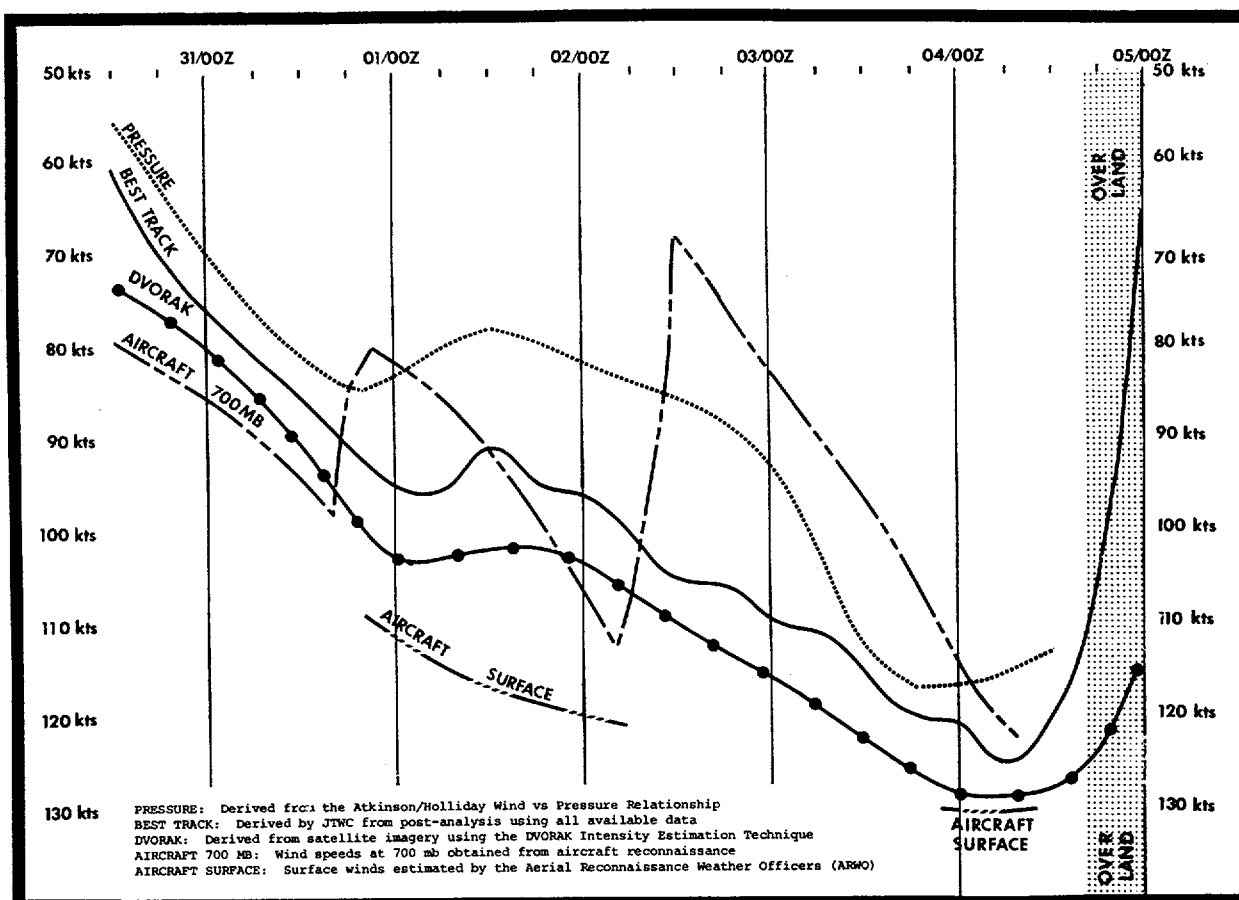


FIGURE 3-25-1. Time series of various intensity parameters evaluated by JTWC while Betty was at typhoon strength. Note the large scatter in the traces until 040600Z.

The decision to abandon a forecast re-curve track east of Luzon put the central and northern provinces of Luzon on alert. At 041600Z, Typhon Betty, packing 120 kt (62 m/sec) winds, slammed into central Luzon south of Cape San Ildefonso. Most weather observing stations stopped reporting prior to Betty's approach, so her actual intensity as she crossed Luzon can only be inferred from a JTWC study of prior tropical cyclones crossing the Philippines (Sikora, 1976), satellite imagery (Dvorak intensity estimates), and aircraft reconnaissance reports just prior to and after

Betty crossed Luzon. However intense Betty may have been, there is little doubt that she was one of the most destructive typhoons of recent history. Initial reports received several days after Betty crossed Luzon indicated at least 81 people dead, thousands homeless, and extensive crop damage from flooding and mudslides. The Cagayan Valley in northern Luzon, hard hit by Betty, lost most of its rice crop from floodwaters which rose to roof-top level in some areas. Philippine Defense Minister, Juan Ponce Enrile, described the Cagayan Valley from a helicopter survey, stating, "It looks like a sea from the air."

As Betty weakened over Luzon, the ridge that influenced her track into the Philippines broke down, thus, allowing her to drift northward along the Cordillera Central Mountains and eventually to be drawn into the weak short wave trough which had stalled off the coast of Taiwan. Emerging from Luzon as a 45 kt (23 m/sec) tropical storm, Betty

never regained her earlier fury as she moved east of Taiwan and the Ryukyu Islands before undergoing an extratropical transition just prior to 080000Z. As an extratropical system, the remnants of Betty did not persist long. This once powerful typhoon was last observed 12 hours later dissipating southeast of Honshu, near 32N 143E.

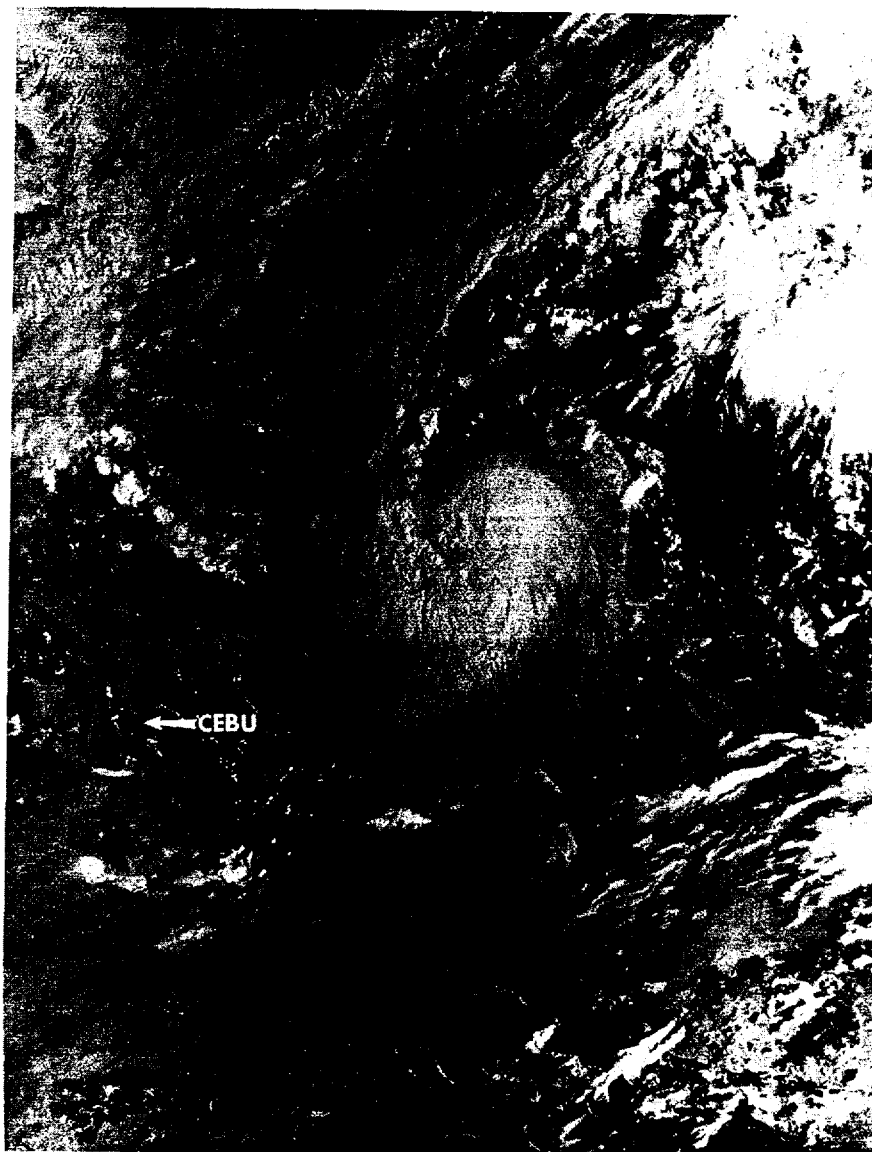


FIGURE 3-25-2. During this stage of Typhoon Betty's development, intense banding was reported by aircraft reconnaissance along with areas of surface winds in excess of 100 kt (51 m/sec), 31 October 1980, 2252Z. (NOAA6 imagery)